Section 149—Construction Layout

149.1 General Description

Perform construction layout to guide and control performance of items of the work according to this Specification.

This work includes:

- Placing, replacing (if necessary), and maintaining construction layout points.
- Preparing construction layout drawings, sketches, and computations.
- Recording data in field books such as alignment, slope stake, blue top, drainage layout, bridge, and other books used for layout for this Project.

149.1.01 Definitions

General Provisions 101 through 150

149.1.02 Related References

A. Standard Specifications

General Provisions 101 through 150

B. Referenced Documents

General Provisions 101 through 150

149.1.03 Submittals

Submit the following documentation to the Department:

A. Project Construction Records

These records detail information that the Department uses to determine the template line for the as-built cross sections, which defines the computation line for unclassified excavation. These records include:

- Survey records
- Bound field notebooks
- Computer printouts that record the Project's construction

Prepare the records as directed by the Engineer.

B. Survey Documents

Furnish the Engineer with a copy of survey documents that relate to construction layout. Provide these documents when the Engineer requests or as they are completed. The Engineer may check the documents for accuracy and may require revisions where necessary. The documents become Department property and will be included in the permanent Project records.

C. Drainage Structure Sketches

Profile both inlet and outlet ends of proposed drainage structures for at least 100 ft (30 m) in the existing ditch line or stream bed. Adjust flowline elevations, if necessary, to enhance the hydraulics and to reduce silting, scouring, or backwater.

Calculate the length of each structure and provide sketches of the structure to the Engineer for review and approval at least 24 hours before beginning the work.

D. Bridge Layout Sketch

Furnish a layout sketch before staking on bridges. After staking, submit a revised sketch for the Engineer's review and approval before beginning construction. Include in the layout sketch relevant stations, angles, dimensions, and redundant checks including exterior beam dimensions in each span. Also include all horizontal and vertical clearances with calculations that verify the clearances shown.

Submit for the Engineer's review and approval survey data and calculations with the layout sketch and information required for bent construction.

Verify the Plan elevations for all bridge bearing seats on the substructure.

E. Wall Layout Sketches

Submit sketches and other data verifying either that the wall will fit the final field conditions, or indicate where revisions are necessary. Submit these sketches well before the wall construction begins so the Engineer can make any necessary structural design changes.

149.2 Materials

General Provisions 101 through 150

149.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150

149.3 Construction Requirements

General Provisions 101 through 150

149.3.01 Personnel

Furnish personnel capable of establishing line and grade points necessary to complete the the work. Establish these points within the generally accepted surveying tolerances, and ensure that they are acceptable for the the work being performed.

149.3.02 Equipment

Furnish surveying equipment, stakes, and all materials necessary to perform the the work, subject to the Engineer's approval.

149.3.03 Preparation

A. General Pre-Construction

Before beginning construction:

1. Ensure that plan dimensions, alignment, and elevations are compatible with existing field conditions. Make adjustments where necessary.
2. Ensure alignment tie-ins by coordinating construction layout with that of other Contractors whose work abuts any portion of the work. All adjustments are subject to the Engineer's approval.

B. Widening and Reconstruction

Before beginning construction where existing pavement is to be retained either for widening or for reconstruction:

1. Take three-point levels of the pavement throughout the length to be retained.

   Normally, the three-point levels will be required at 50 ft (15 m) intervals. However, the Engineer may adjust these intervals according to existing field conditions.
2. From the three-point levels, prepare a graphic grade plot that "best fits" the existing pavement to minimize the leveling requirements (if any) of the existing roadway. Cross slopes may be varied within the ranges shown on the Plans or adjusted by the Engineer to produce the "best fit."
3. On passing lane or widening Projects where existing pavement is not to be overlaid:
   a. Profile and plot the outside edge of the existing pavement to obtain a smooth profile grade.
   b. Transfer this grade to the new edge of paving using the proper cross slope.
4. Furnish data to the Engineer for approval before beginning widening and reconstruction.
5. On widening, reconstruction, or passing lane projects, obtain the Engineer's approval of the "best fit" profile. Ensure that grade stakes are set to control the construction of any required widening based upon the "best fit" profile and cross slope. Construct proposed widening flush with the existing edge of paving. Provide positive drainage in all cases.

C. Existing Bridge Widening or Modification

To widen or modify existing bridges, do the following before ordering materials or beginning construction:

1. Verify existing elevations and dimensions as well as confirm or determine required new cap elevations.
2. Profile the removal line and cross section the existing deck.
3. Use this profile information to determine a "best fit" finished grade for the widened portion.
4. Compute the new cap elevations based on this "best fit" information.

5. Furnish survey data, layout sketch, and calculations to the Engineer for approval.

D. Retaining Wall Construction Layout

Set stakes, take necessary cross sections, and perform necessary calculations at each wall before beginning wall construction to ensure that the geometric design of the retaining wall conforms to actual conditions.

149.3.04 Fabrication

General Provisions 101 through 150

149.3.05 Construction

A. Verify Plan Elevations

Verify plan elevations for all bridge bearing seats on the substructure.

B. Verify Bent Layout

After bent construction has begun, verify bent layout at each major phase of the construction to ensure that the bent is properly positioned in relation to adjacent bents.

C. Establish the Centerline

Establish the centerline as follows:

1. Establish or reestablish the centerline from the monuments and/or reference points the Department will provide.
2. On widening or reconstruction Projects, establish the horizontal and vertical alignment of the existing roadway and bridges.
3. Modify the Plan horizontal and vertical alignment to conform to the existing alignment as necessary.

D. Verify the Accuracy of the Bench Mark(s)

The Department will furnish at least one bench mark that the Contractor shall preserve, and if necessary, relocate as follows:

1. Verify the accuracy of the bench mark(s) and report discrepancies to the Engineer.
2. Establish additional benchmarks needed for construction.
3. Maintain the bench marks for necessary Department checks.

E. Flag In-Place Survey Control Monuments

Flag and protect in-place survey control monuments and reference points, including Right-of-Way/property line intersections, as follows:

1. Pay for and replace destroyed or disturbed stakes or monuments.
2. When included as Pay Items, stake Right-of-Way markers.

F. Line, Grades, and Stakes

Set other line and grade stakes needed to construct the job, including stakes needed to relocate utilities and restake flattened slopes, minor grade or alignment changes, and other incidentals.

G. Stake Centerline Control Alignments

Stake centerline control alignments shown on the Plans or adjusted as described above when the Department needs accurate measurement of quantities for payment. Stake these control alignments as follows:

1. Stake the alignments to an accuracy of 1:5000.
2. Stake the alignments just before the Department takes aerial photography or field cross sections for both original and final cross sections.
3. Provide the Department with elevations of positions staked for the Department’s quantity measurements. Ensure that these elevations are of third order accuracy, or better. Determine them using the differential leveling method.
4. Take intermediate cross sections required because of stage construction, detours, or other reasons.

H. Provide Graphic Sketches

Prepare and use graphic sketches of superelevation runout on curves on multi-lane roadways and of tie-ins of ramps to mainline on freeways and expressways to help provide positive drainage, adequate superelevation, and a pleasing appearance. Prepare and use similar sketches for street or roadway intersections.

I. Maintain the Stakes

After construction has begun in any segment of the Project, maintain the stakes that identify construction station numbers and locations as follows:

1. Ensure that stakes are placed at intervals not to exceed 200 ft (60 m) and use even, 100 ft (30 m) stations.

   Mark and flag stakes so that they are visible to DOT Project personnel in that segment of the Project until construction is complete.
2. During grading activities in fills or cuts over 20 ft (6 m), extend slope stakes up or down the slopes in intervals of 10 ft (3 m) or less to achieve an accurate cross section.

J. Traffic Markings

When traffic markings are to be placed by either the Contractor or others, furnish the layout and clean and preline the surface to allow the placement of permanent pavement markings on the Project.

When traffic markings are not included in the Project plans, the Department will provide striping plans and/or standard drawings for the Contractor's use.

K. Provide Bridge Construction Layout

Provide alignment control, grade control, and calculations to set these controls for bridge construction.

For new bridges, the Department will furnish the necessary input data forms for the Department's "Bridge Geometry" computer program upon the Contractor's request. The Department will process the data to help the Contractor obtain finished deck elevations.

Data processing is available only as an alternate service to determine elevations. If this service is elected for use, prepare the input data and the Department will furnish the output data. The following limitations apply:

- The Department will not assume liability for the accuracy of either input or output data.
- The Department will limit this service to two programs per bridge.
- This service is not available for existing bridges that are to be widened. Finished deck elevations for bridges that are to be widened will not be furnished.

149.3.06 Quality Acceptance

The Engineer's acceptance of all or any part of the Contractor's layout shall not relieve the Contractor of responsibility to secure proper dimensions for the completed work. Correct at the Contractor's expense work incorrectly located due to layout error.

149.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150

149.4 Measurement

This item is not measured for payment.

149.4.01 Limits

General Provisions 101 through 150

149.5 Payment

This work is not paid for separately. The costs for performing layout work as described in this Specification are included in the bid for the items of work to which the layout is incidental.

Any unnecessary work, overruns, costs, etc., resulting from inaccurate data submitted by the Contractor will be deducted from Contractor payments.

149.5.01 Adjustments

General Provisions 101 through 150